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Report on the Billings-Great Falls highway

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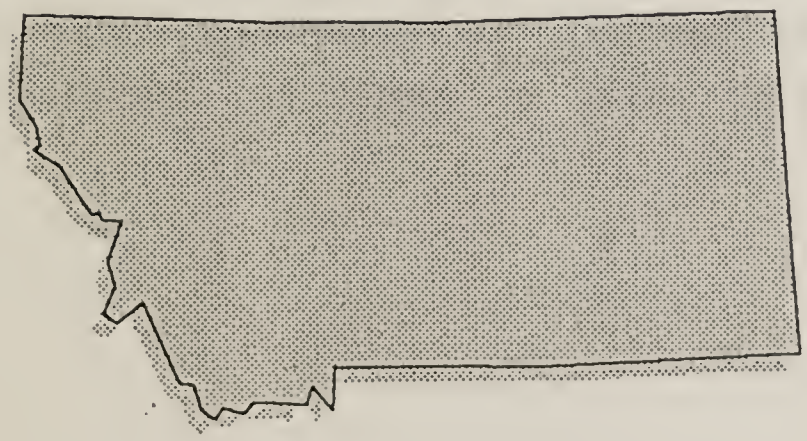
Report on the Billings-Great Falls Highway

December 1, 1994



Montana Department of Transportation

Transportation Planning Division

Y80.CB3.01

Introduction

In 1993, the 53rd Legislature asked the Montana Department of Transportation (MDT) to review the highway leading most directly between Billings and Great Falls and, "prepare a written report encompassing the condition of the highway and the improvements made and planned to be made." The Legislature asked the Department to complete this report by December 1, 1994.

In complying with the Legislature's request, MDT has reported not only on the condition and improvement plans for this highway, but has also attempted to present, wherever possible, information that provides a statewide or system-wide perspective on highway conditions and needs. The Department feels this approach is appropriate given Montana's vast highway system and the limited funds available for highway improvements.

There is considerable interest in some communities in this route's role in international trade. This report therefore also examines the movements of truck traffic through Montana and provides cost estimates for highway improvements that have been proposed to support or encourage this trade.

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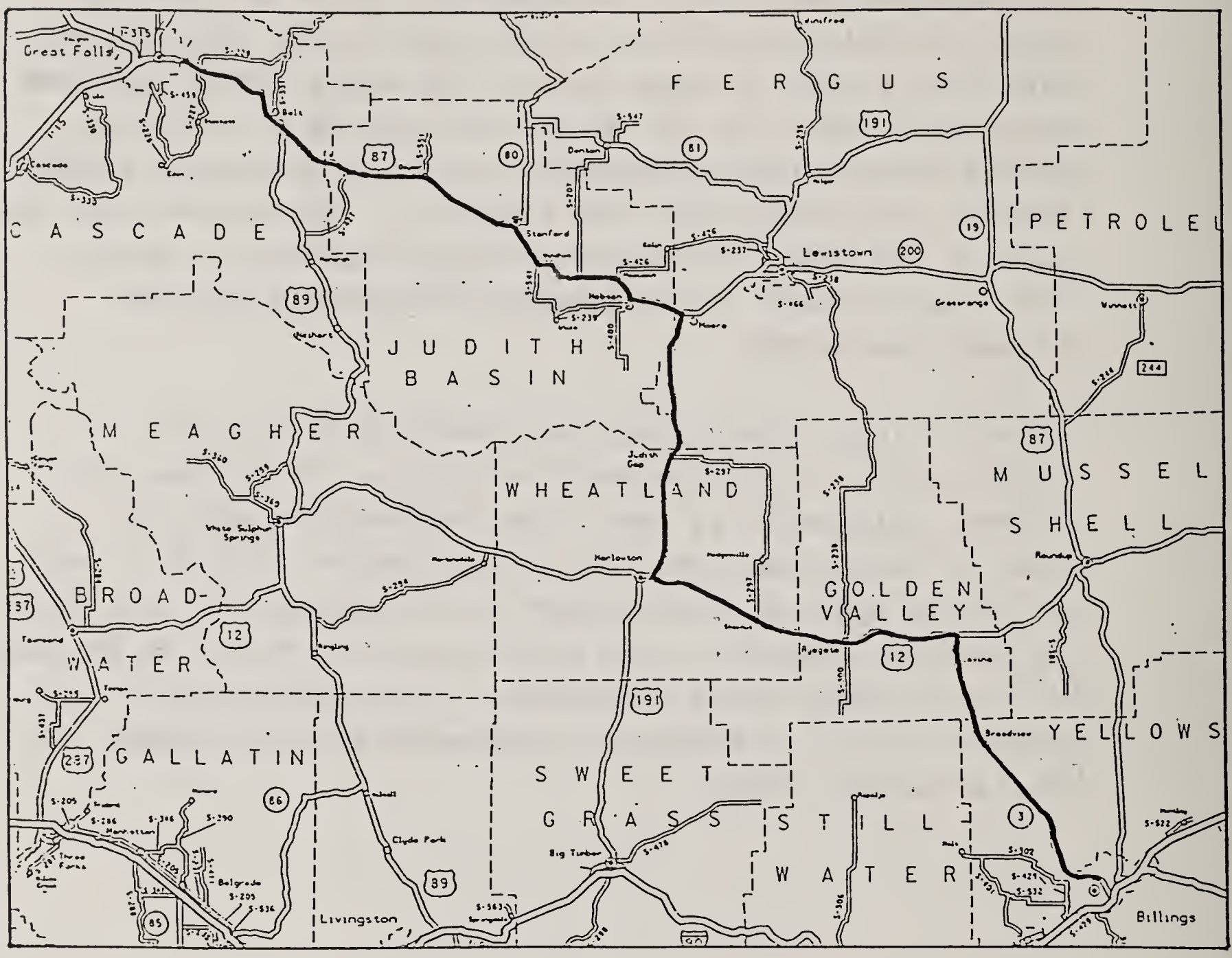
Route Description

For the purposes of this report, the highway between Billings and Great Falls is considered to be the 209 mile route from Zimmerman Trail in Billings to the intersection with 57th Street in Great Falls. The route, which includes sections of MT 3, US 12, MT 200, US 191, US 87 and US 89, passes through the incorporated cities of Broadview, Lavina, Ryegate, and Judith Gap (See Figure 1). The entire route is part of the over 3,800 miles of major highways in Montana that are included in the federally-designated National Highway System(NHS).

From Billings, the highway runs north on MT 3 to an intersection with US 12 north of Lavina. From there, the highway follows US 12 west to an intersection with US 191 east of Harlowton, north to an intersection with US 87 and MT 200 at Eddie's Corner, west to an intersection with US 89 at Armington Junction, and finally west on US 87, US 89, and MT 200 to Great Falls. The entire route substantially parallels that of Burlington Northern Railroad's Great Falls-Mossmain line.

Billings-Great Falls Highway
Figure 1
Route



Physical Characteristics

Average pavement and roadway widths, pavement conditions, and right-of-way widths are described in Table 1. Pavement widths generally reflect two 12 foot driving lanes with shoulder widths from 3 to 8 feet. Present Serviceability Index, or PSI, is a standard national measure of pavement

condition with a rating of 5 for excellent pavement, 3 for average pavement, and 0 for extremely poor pavement. Due to the widespread use of friction materials and the sensitivity of the Department's testing equipment, Montana's major two-lane highways rarely produce PSI ratings greater than 4. Bridge structural evaluation ratings reflect a scale from 0 for poor to 9 for excellent as described in "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges".

Billings-Great Falls Highway
Table 1
Physical Characteristics

Segment	Length (Miles)	Average Width (Ft.)			Average Condition	
		Surface (Paved)	Roadway (Total)	ROW	Pavement (PSI)	Bridge (Struct. Eval.)
Billings (Zimmerman Trail)-Lavina	40.5	32	45	110	3.5	7
Lavina-Harlowton	45.2	33	45	130	3.6	5
Harlowton-Eddie's Corner	39.2	31	53	150	3.7	6
Eddie's Corner-Armington Junction	64.9	35	48	120	3.9	7
Armington Jct.-Great Falls (57th Street)	19.5	41	53	160	3.7	7
TOTAL	209.3	34	48	130	3.7	6

Design standards for reconstruction projects on this route are described in MDT's "Geometric Design Standards". In general, the standards require a minimum 40 foot surface width with passing lanes where warranted. These standards generally result in two 12 foot driving lanes with 8 foot shoulders. Design standards for new bridges conform to federal HS-20 standards which are the same as Interstate

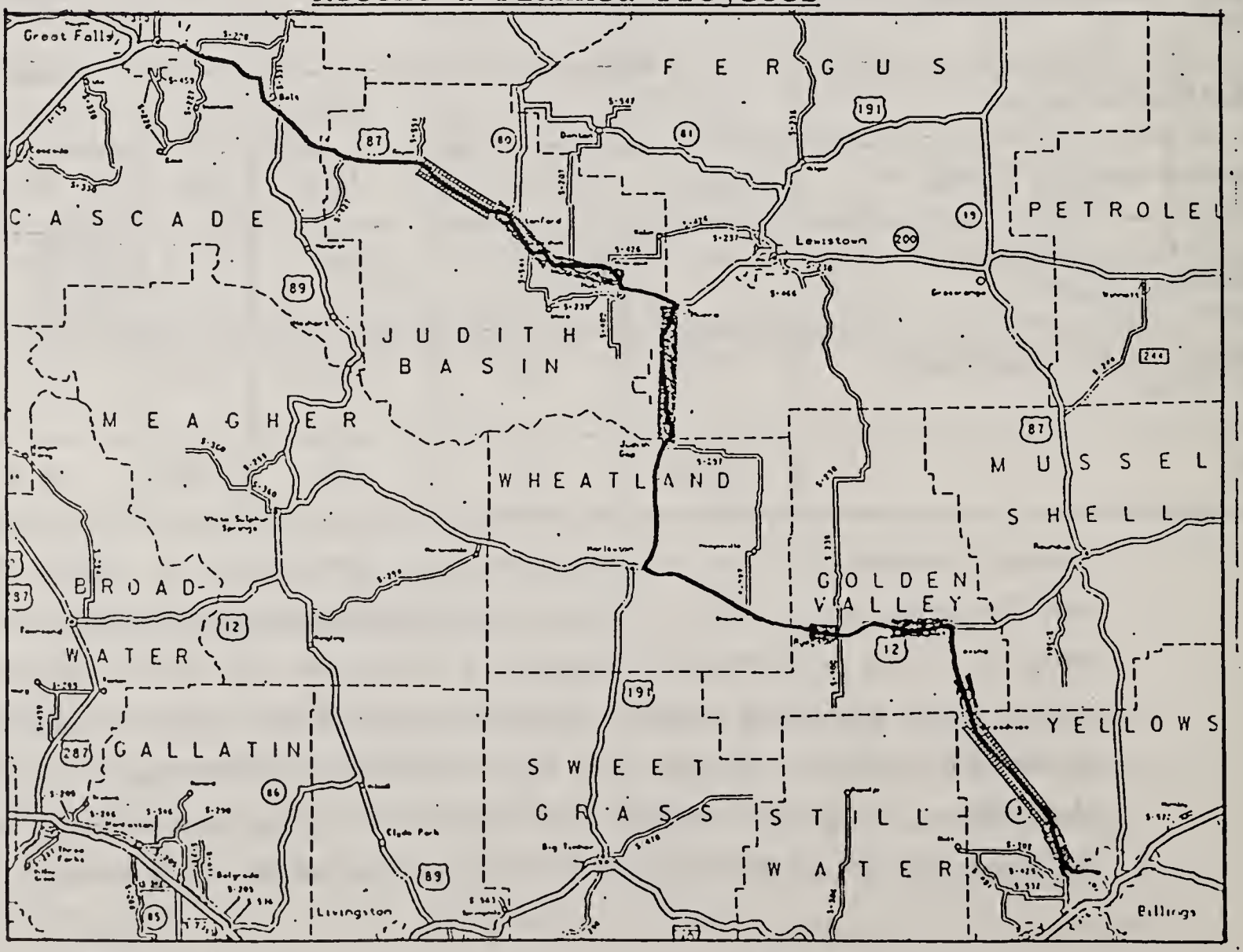
standards. Approximately 60% of the 36 existing bridges meet these standards.

Since January of 1990, MDT has completed 8 major projects valued at $44 million which have substantially upgraded over 60 miles of the Billings-Great Falls Highway (See Figure 2). The projects included 4 reconstruction projects, 2 widen and overlay projects, and 2 overlay projects. In addition, the Department has under construction the 10 mile long, $9.5 million Eddie's Corner-South reconstruction project with completion estimated in 1995. Future projects under development for construction through 2001 total nearly $18 million in value and 30 miles in length (See Table 2). The largest of these projects is the 12 mile long, $7.3 million Acton-NW project northwest of Billings.

Billings-Great Falls Highway

Figure 2

Recent & Planned Projects



Billings-Great Falls Highway
Table 2
Planned Projects

PLANNED PROJECT	TYPE OF WORK	LENGTH	ESTIMATED LETTING DATE	ESTIMATED* COST (MILLIONS)	FUNDING SOURCE
Broadview-South	Reconstruction	6.2	November, 1994	6.5	NHS
Acton-NW	Widen & Overlay	11.5	March, 1999	7.3	NHS
Geyser-Stanford	Widen & Overlay	12.5	February, 2001	4.0	NHS
TOTAL		30.2		17.8	

*Includes preliminary engineering, construction and construction engineering.

Operational Characteristics

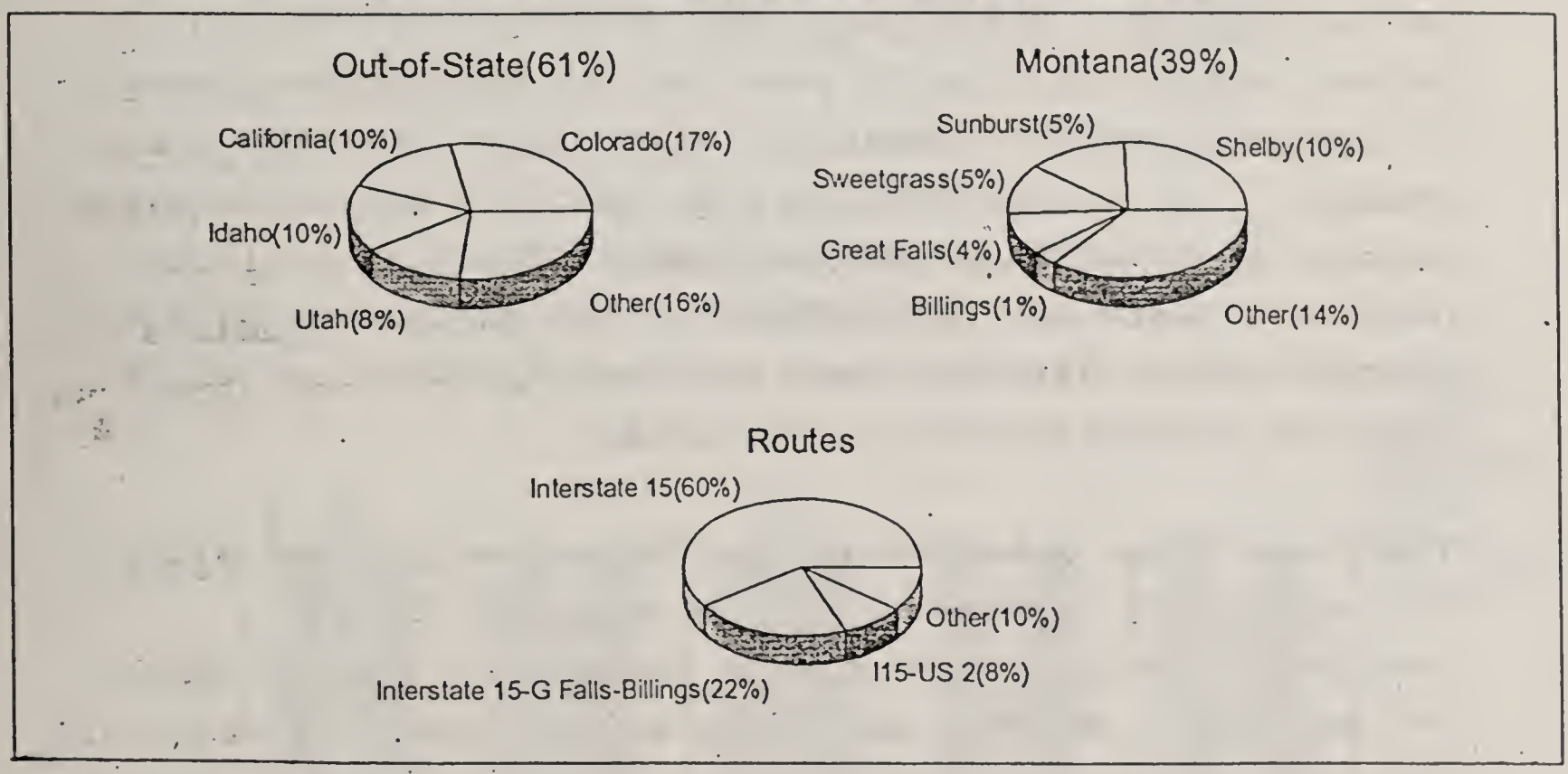
Existing and estimated future traffic volumes on the highway are shown in Table 3. Traffic volumes in similar highway corridors in Montana are provided for comparison. Average annual daily traffic, or AADT, is the measured or estimated daily two-way traffic. Commercial traffic includes both trucks and buses and is based on automatic classification counts verified through visual surveys. Traffic counts are collected at numerous temporary sites and at the Department's two permanent counters near Geyser and Ryegate. Future volumes are based on estimates developed for TranPlan 21, MDT's statewide transportation plan, and reflect a combination of county-specific socioeconomic projections and historic growth factors.

Table 3
Billings-Great Falls Highway
Average Annual Daily Traffic
(Includes similar NHS highways for comparison)

HIGHWAY	SEGMENT	1993		2015
		ALL VEHICLES	COMMERCIAL	ALL VEHICLES
Billings-Great Falls	Billings-Lavina	1,480	260	2,010
	Lavina-Harlowton	1,180	190	1,600
	Harlowton-Eddie's Corner	1,360	330	1,850
	Eddie's Corner-Armington Jct.	1,880	380	2,560
	Armington Jct.-Great Falls	3,350	410	4,290
	AVERAGE	1,690	310	2,280
Missoula-Kalispell	DeSmet Int.-St. Ignatius	6,500	860	9,490
	St. Ignatius-Polson	8,000	780	11,680
	Polson-Kalispell	4,410	570	6,440
	AVERAGE	5,960	710	8,700
Great Falls-Glasgow	Bootlegger Trail-Fort Benton	2,070	280	2,650
	Fort Benton-Havre	1,390	160	1,780
	Havre-Malta	2,180	210	2,700
	Malta-Glasgow	1,320	190	1,540
	AVERAGE	1,740	200	2,150

Information on the origin and destination of traffic on rural highways such as the Billings-Great Falls Highway isn't normally collected. However, due to the interest in the use of this route for international trade the Department conducted a special survey of large trucks at the Coutts-Sweetgrass Border Station in September of 1994. The survey was designed to determine the origins and destinations of southbound trucks as well as the drivers' planned highway route through Montana. The survey was conducted over a three day period and involved over 150 drivers. The results of the survey are shown in Figure 3.

Billings-Great Falls Highway
Figure 3
Destinations of Southbound Trucks at Coutts-Sweetgrass



The origin-destination survey found that approximately 61% of southbound trucks were destined for points outside of Montana. The largest single out-of-state destination was Colorado with 17% of the total, followed by California and Idaho with 10% each. In-state destinations were mostly along the Interstate 15 corridor from Sweetgrass to Great Falls. Interstate 15 was also the most-used single highway with 60% of the drivers saying that it was the only highway they would be on within Montana. The Billings-Great Falls

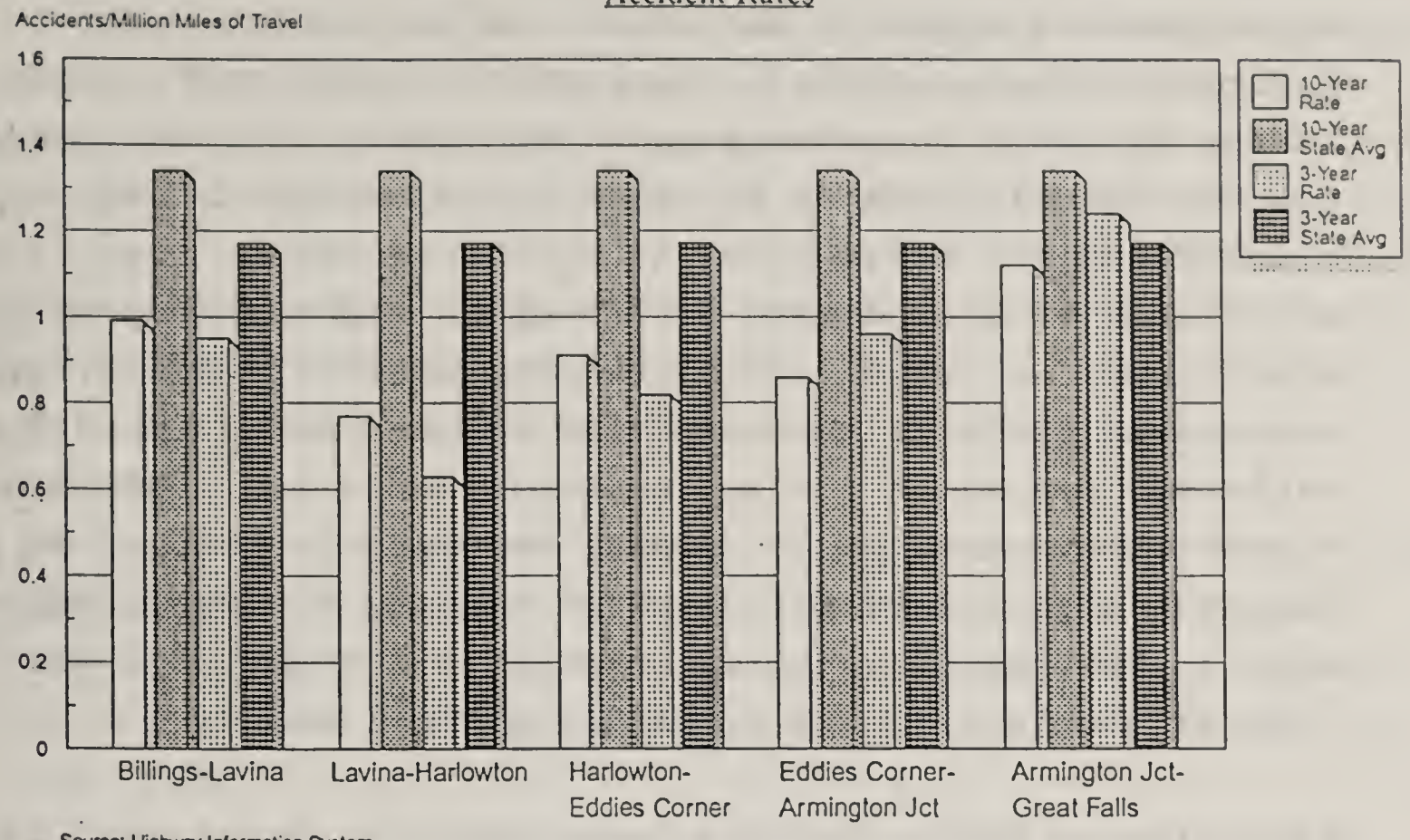
Highway was second with 22% due to the large number of drivers destined for Colorado and other points south and east of Billings.

Figures 4 and 5 show the rate and severity of accidents on the highway compared to state averages. Accident rate is the calculation of the number of accidents for each million miles traveled whereas accident severity reflects the seriousness of the accidents. In general, the accident rate on the Billings-Great Falls Highway is well below both the 3 year and 10 year state averages except on the Armington Junction-Great Falls segment where the 3-year rate is slightly higher than the state average. Accident severity is also at or below state averages except on the Billings-Lavina segment. The 3-year rate on the Harlowton-Eddie's Corner segment and the 10-year rate on the Eddies Corner-Armington Junction segment are also higher than the state average. It is important to note that the Billings-Lavina segment is scheduled for significant improvements in the next five years and the portion of the Harlowton-Eddie's Corner segment with the most accidents in the last three years is currently under construction.

There are three intersections with stop signs that affect through traffic between Billings and Great Falls. Northbound traffic must stop at Lavina and Eddie's Corner and southbound traffic must stop at Harlowton. MDT turning movement studies at these intersections indicate negligible delays for through traffic.

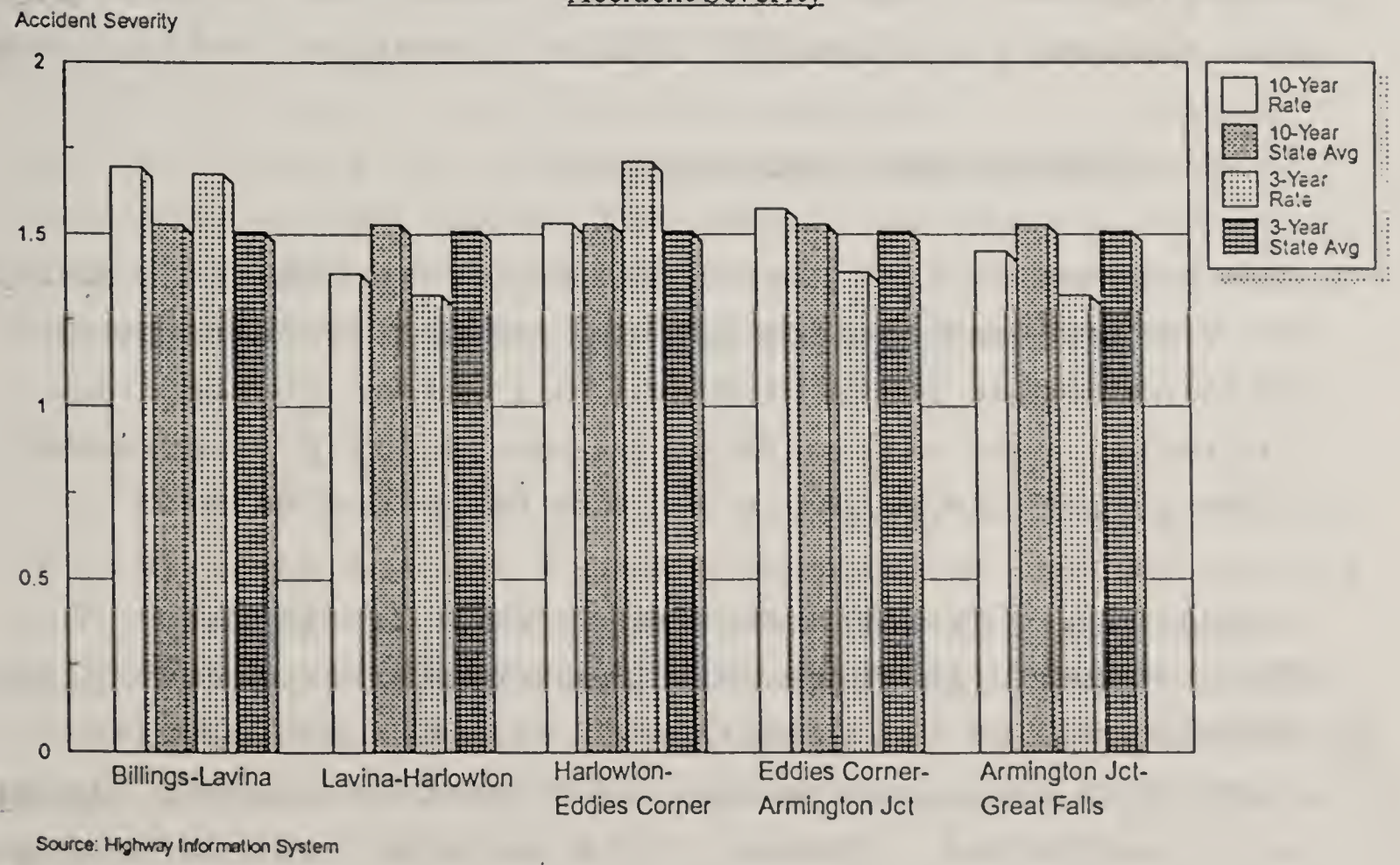
Approximately 95% of the highway is posted with 55 mph speed limits with speed limits of 35 and 45 mph in or near incorporated cities. The design speed for most of the highway is 60 mph.

Figure 4
Billings-Great Falls Highway
Accident Rates



Source: Highway Information System

Figure 5
Billings-Great Falls Highway
Accident Severity



Source: Highway Information System

Level-of-service(LOS) is frequently used to compare traffic operations of highways and determine the need to add capacity and provides a measure of the quality of traffic movements based on factors such as traffic volumes, percent trucks, terrain, number of lanes, and shoulder widths. LOS classifications range from "A" which represents free-flow conditions with no delays to "F" which represents gridlock conditions. A LOS of "B" represents generally free-flowing conditions where drivers may move at the posted speed limit with only occasional delays caused by oncoming traffic or slower moving vehicles. Highway capacity is defined as the highest volume of traffic a given highway can accommodate at LOS E. MDT normally attempts to provide a LOS of B when designing major highway projects in rural areas.

According to MDT's "Primary Data Summary", nearly all of the Billings-Great Falls Highway is currently operating at a LOS of either "A" or "B". This is a considerably better quality of traffic flow than similar highways in the state. For example, most of US 93 between Missoula and Kalispell has LOS ratings of "C" or "D" with an occasional rating of "E".

Construction Scenarios and Costs

One purpose of this report is to compare the estimated costs of various construction options for improvements to the Billings-Great Falls Highway. Six different scenarios including four alternatives to the likely program were chosen for this analysis and are described below.

Scenario 1: Projects currently under development.
This scenario includes only those projects currently under development by the Department. As these projects are completed new projects will no doubt be selected, designed, and constructed. However, this scenario assumes only the completion of the currently programmed projects.

Projects under this scenario are subject to the standards for non-Interstate NHS routes in the Department's "Geometric Design Standards". These standards require a 40 foot surface for reconstruction projects and at least a 28 foot surface for overlay and overlay and widening projects.

Scenario 2: Planned projects plus continued completion to NHS standards.

This scenario assumes the Department will continue to program additional projects on this route as current projects are completed. Assuming the same construction rate that occurred between 1990 and 2001, this option would result in approximately one reconstruction project as well as one overlay or overlay and widening project per year on the route.

Alternative A: Number 2 plus additional passing lanes and elimination of stops.

Under this alternative the highway would continue to be upgraded to full NHS standards with special added features to facilitate the movement of through traffic. All major highway projects would include staggered .75 mile-long passing lanes at 10 mile intervals. In addition, intersections at Lavina, Harlowton, and Eddie's Corner would be realigned to eliminate stops and provide uninterrupted through movements between Billings and Great Falls.

Alternative B: Undivided 4 lane.

This alternative would produce a highway with four 12 foot driving lanes and two 8 foot shoulders for a total surface width of 64 feet. Unlike previous alternatives, this alternative would require additional right-of-way and the widening or replacement of all bridges. Right-of-way width would average 150 feet. The highway's route would remain the same.

Alternative C: Divided 4 lane.
The section of US 87 just east of Great Falls has four 12 foot driving lanes, two eight foot shoulders, and one 12 foot paved median. Alternative C would essentially extend this standard for the entire route. Unlike Alternative B, this design would allow for the use of existing bridges for one direction of travel. Additional right-of-way would be required although the highway's route would remain the same. Right-of-way would average 170 feet in width.

Alternative D: Interstate standards.
Interstate standards normally provide two 38 foot surfaces separated by a 42 foot unpaved median. Access is restricted to interchanges and frontage roads are often used for local access. The existing highway could either serve as a frontage road or as one half of the new highway where it met interstate standards. Average right-of-way widths of 475 feet may require major changes in the highway's alignment to avoid environmental disruptions. A route study would be necessary to determine the best alignment and an Environmental Impact Statement (EIS) would probably be required. Interstate standards would also require the bypassing of communities along the route and the construction of additional major links to existing interstate highways at each end of the route. A link to Interstate 15 at Great Falls would require two bridges across the Missouri River.

Cost estimates for the six construction scenarios are shown in Table 4. Estimates are based on historical project costs where possible and reflect 1994 costs. Overall, the estimates reflect the most conservative scenarios and should therefore be considered as minimum estimates. Assumptions common to all scenarios are:

Right-of-Way Costs: Based on the latest available project information, right-of-way costs along this route vary from

$4,000/acre for some small residential tracts north of Billings to $100/acre for native rangeland. To simplify, a figure of $200/acre was used for this analysis.

Preliminary Engineering Costs: Preliminary engineering(PE) activities include environmental documentation and design of the project. PE is usually estimated at 10% of the estimated construction cost of a project unless the project involves significant environmental or design problems. A 10% PE figure was used for this analysis.

Construction Engineering Costs: Construction engineering(CE) activities include construction inspection and management activities and any additional design work necessary for completion of a project. CE is usually estimated at 10% of the estimated construction cost for overlay or overlay and widening projects and 15% for construction or reconstruction projects.

Estimated Unit Construction Costs:

2 lane overlay: $205,000/mile
2 lane widen & overlay: $290,000/mile
2 lane reconstruction: $870,000/mile
1 climbing lane or median construction: $150,000/mile
4 lane Interstate construction: $1,900,000/mile
2 lane Interstate construction: $1,200,000/mile
1 Interstate interchange construction: $4,000,000
1 intersection realignment: $120,000
1 Missouri River bridge: $6,000,000

NOTE: Actual project cost estimates are used for projects under development.

Table 4
Billings-Great Falls Highway
Construction Cost Estimates

SCENARIOS	ASSUMPTIONS	CONSTRUCTION	ROW	PE	CE	TOTAL
1. Projects currently under under development.*	6.2 Miles Reconstruction 24 Miles Widen & Overlay ROW: None	$ 14,700,000	0	$ 1,400,000	$ 1,700,000	$ 17,800,000
2. Number 1 projects plus completion to NHS standards.	Number 1 plus following improvements: 54 Miles Reconstruction 36 Miles Widen & Overlay 6 Miles Overlay ROW: None	$ 73,300,000	0	$ 7,300,000	$ 9,900,000	$ 90,500,000
Alternative A: Number 2 plus additional passing lanes and elimination of stops.	Number 2 Plus: 40 .75 Mile-Long Passing Lanes 3 Realigned Intersections ROW: None	$ 78,200,000	0	$ 7,800,000	$10,400,000	$ 96,400,000
Alternative B: Undivided 4-lane	Number 2 Plus: 205 Miles 2-Lane Const. ROW: 500 acres	$251,600,000	$ 100,000	$25,100,000	$36,700,000	$313,500,000
Alternative C: Divided 4-lane	Alternative B Plus: 205 Miles Median Const. ROW: 500 acres	$282,300,000	$ 200,000	$28,200,000	$41,300,000	$352,000,000
Alternative D: Interstate Standards	Use of 60% or 125 miles of existing highway for 2 lanes of travel with no improvements. 125 Miles 2-Lane Const. 99 Miles 4-Lane Const. Including 15-mile link to existing Interstates 2 Missouri River Bridges 17 Interchanges No new construction of frontage roads. ROW: 10,900 acres	$418,100,000	$2,180,000	$41,810,000	$62,715,000	$524,805,000

*See Table 2 for estimated dates of contract letting.

Funding Options

Funding options for major highway improvement projects can vary based on the type of project planned and the official designation of the route. The following summary describes potential funding sources for major improvement projects on the Billings-Great Falls Highway.

Interstate Construction (IC): This funding category provided funds for the initial construction of segments of the Interstate Highway System. In 1991, Congress declared in the Intermodal Surface Transportation Efficiency Act (ISTEA) that; "the authorizations of appropriations and apportionments for construction of the Dwight D. Eisenhower National System of Interstate and Defense Highways made by this section...are the final authorizations of appropriations and apportionments for completion of construction of such System." With this statement, Congress officially recognized the completion of the Interstate Highway System and the end to this funding category.

Interstate Maintenance (IM): IM funds are available for major maintenance projects on existing Interstate Highways. These projects include reconstruction, rehabilitation and overlay projects designed to maintain the integrity of the existing Interstate System. Construction of new sections of Interstate are not eligible for IM funding. Lack of IM funding for long-term preservation of the facility would be a major problem if the Billings-Great Falls Highway was upgraded to 4-lane or Interstate standards.

National Highway System (NHS): The entire length of the Billings-Great Falls Highway is part of the proposed National Highway System, a federally-designated system of approximately 160,000 miles of major highways of national or international significance. Montana receives approximately $37 million per year in federal NHS funds for construction

projects on the over 2,600 miles of Montana's non-Interstate highways that are part of this system. NHS funds can be used for most major construction activities.

Demonstration Projects: Congress occasionally allocates federal funds directly to specific "demonstration" projects. This practice takes funds off the top of the total federal transportation funding pot before the funds are distributed to states by formula. In general, donee states such as Montana that benefit from the distribution formulas are the net losers when Congress funds these projects. Demonstration projects also require 20% in state matching funds rather than the 13% required for funding categories such as NHS.

North American Free Trade Agreement (NAFTA): The goal of NAFTA was to encourage an open border for trade between Canada, the US, and Mexico. However, in approving NAFTA, Congress did not establish a special funding category for infrastructure improvements related to increased trade resulting from the agreement.

Toll: Major metropolitan areas are increasingly using toll mechanisms to fund major highway improvements. This practice has substantial drawbacks, however, that would make it impractical in Montana.

Toll facilities are normally financed through the sale of bonds by a state or local government . The bonds are then repaid through the collection of tolls. Due to the high cost of infrastructure investments, the sale and repayment of the bonds is only feasible if the facility has high traffic volumes. Volumes of more than 50,000 vehicles per day are normal on most successful toll facilities.

Strategic Highway Corridor Network (STRAHNET): According to the Military Traffic Management Command, the STRAHNET is a system of highways that, "is a key deterrent in U.S. strategic policy. It provides defense access, continuity and emergency capabilities for movements of personnel and equipment in both peace time and war time." The STRAHNET consists of the Interstate System and nearly 15,000 miles of non-interstate routes. In designating STRAHNET routes, the Department of Defense considers the distances between military installations and the ability of highways to accommodate military traffic.

The designation of the Billings-Great Falls Highway as a STRAHNET route was one factor in MDT's decision to nominate the route for NHS designation to insure funding for long-term maintenance of standards. However, STRAHNET doesn't provide any special funding for highway improvements.

Maintenance Funds: Although maintenance funds wouldn't be used to fund major improvements to the Billings-Great Falls Highway, the impact of possible improvements on maintenance costs must be noted. In general, any major widening of a highway that adds lane miles or structures increases long term maintenance costs. This increase can be substantial if new maintenance facilities are necessary. The State would have to cover this added expense since maintenance costs aren't eligible for federal funding.

Program Impacts

Of the various options available for funding major highway improvements, the NHS funding category provides the principal source of funds for NHS routes, such as the Billings-Great Falls Highway. However, the Department is responsible for over 2,600 miles of non-interstate NHS and must therefore consider the needs of the entire system in distributing funds.

To address these needs, the Department is planning approximately 60 major NHS-funded projects statewide through 2001. Most of these projects are long overdue and have strong support from local communities that have worked closely with the Department to develop these projects. Any major redirection of limited NHS funds to one route or corridor would inevitably force the Department to delay projects elsewhere. This would cause significant concern in these communities and would ultimately increase costs as pavements deteriorate to a point where additional surfacing or complete reconstruction is necessary.

Non-Construction Options to Improve Corridor

Given the high costs of highway construction projects other non-construction options could be considered to enhance the movement of freight and people between Billings and Great Falls.

Rail: Burlington Northern Railroad's Great Falls-Mossmain Line roughly parallels the route of the Billings-Great Falls Highway. The line consists of a single track with limited passing sidings and no curves that are considered high hazard. This configuration allows for maximum freight train speeds of 49 mph. The line is currently operating at less than capacity with an average of two trains per day. The line could be upgraded to allow higher speeds for freight trains. Burlington Northern estimates the necessary improvements including safety enhancements, passing tracks and revised track geometry would cost at least $40 million. The railroad currently doesn't plan any major improvements, however.

Improvements for passenger trains would cost considerably more due to standards requiring more passing tracks, improved track geometry, and additional control mechanisms. These improvements would cost an estimated $500,000 to $750,000 per mile for the 223 mile long Great Falls-Mossmain

Line to allow for 80-90 mph passenger service. Costs for passenger terminal facilities aren't included in this estimate.

Although Amtrak has never studied the possibility of adding service between Billings and Great Falls, studies of similar routes have produced negative cost-benefit projections. Also, it is unlikely that Amtrak will add service in rural areas when it is considering dropping service in some urban corridors due to budget problems.

Route Signing: Signing on the Billings-Great Falls Highway currently includes four US and two Montana route designations. US routes are designated by the American Association of State Highway and Transportation Officials (AASHTO) and reflect national considerations. Changes in these designations are therefore rare and sometimes controversial. However, Montana route designations are controlled by the State.

Montana could revise the Montana route signing on the Billings-Great Falls Highway to provide more consistent signing and enhance the impression with travelers that this route is a single highway. For example, the highway segment from Billings to Lavina is currently designated as Montana 3. This designation could be extended west to Harlowton and north to Eddie's Corner to provide more continuous signing. This would require coincident signing on US 12 and 191.

Any change in route signing can be controversial, however, if a community feels the change will have a negative impact on it's economy. For example, residents and business owners in the Lewistown and Roundup areas may object to the extension of Montana 3 designation if they feel this change would divert travelers from their businesses. These concerns would have to be addressed before any change is made.

Conclusion

The 209-mile long highway between Billings and Great Falls provides an important link between Montana's two largest cities. Recent and planned construction projects on this route are designed to provide a safe and modern 2-lane highway that will provide a high level of service for the movement of people and goods well into the next century. More importantly, planned projects are fundable with existing revenue sources and will not prevent the Department from addressing the other important needs of Montana's vast highway system. Given the high cost of other construction alternatives and the limited funds available, this approach will provide the greatest long-term benefit to Montana's highway users.

Although this highway compares favorably with other similar routes in both physical and operational characteristics, the Department will continue to monitor its condition to insure that any major change in its status is quickly addressed.

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